REMARKS

Claims 1-9 and 19 are pending and have been rejected. Claims 1 and 19 have been amended to include the recitations of claims 3 and 5 which have been canceled, along with claim 4. Claims 20 and 21 have been added to separately recite the embodiments of treatment with nitrogen. Claims 1, 2, 6-9 and 19-21 remain in the case.

Claim 2 is rejected under the second paragraph of Section 112 and has been amended to address the examiner's concern.

Claims 1-2, 6, 8, 9 and 19 are rejected under Section 103(a) based on Carey (US 6280813) in view of Egelhoff [Oxygen as a surfactant in the growth of giant magnetoresistance spin valves], and claims 9 and 19 are rejected under Section 103(a) based on Egelhoff. This rejection has been overcome by incorporating claims 3 and 5 into claims 1 and 19. Withdrawal of this ground of rejection is respectfully requested.

Claims 3 and 5 are rejected under Section 103(a) based on Carey (US 6280813) in view of Egelhoff in view of either Maseeka [JP 2002025032] or Shimizu (US20020127433).

The examiner urges that Carey teaches all of the elements recited in claim 1. He admits that "Carey appears to be silent in allowing at least the interface between said nonmagnetic metal spacer or layers and said ferromagnetic films to adsorb physically oxygen and/or nitrogen. Egelhoff remedies this." As to the recitations of claims 3 and 5, now incorporated in claims 1 and 19, the examiner admits that the combination of Carey and Egelhoff "does not explicitly teach wherein the gas used for forming the nonmagnetic metal spacer layer or layers is a mixed gas obtained by mixing oxygen or nitrogen with Ar or other rare gases." He urges that either Maesaka or Shimizu remedy this failing.

In response, the examiner's attention is directed to Figures 7 and 8 in applicant's specification. Fig. 7 is a graph showing the result of measurement of fluctuation field Hf in an embodiment of the present invention. Fig. 8 is a graph showing the result of measurement of KuVlksT in an embodiment of the present invention.

Fluctuation field Hr (Oe) and an index of thermal stability KuVIkBT were measured for to the magnetic recording medium according to the present invention. The results of the measurements are shown in Figs. 7 and 8. As Figs. 7 and 8 show, all of the magnetic recording media produced by the production method related to the present invention have a KuVIkBT

value of 80 or more indicating that they are magnetic recording media which are excellent in thermal stability. And the higher the partial pressure of oxygen during the forming of the nonmagnetic metal spacer layer 4, the more the fluctuation field Hf is reduced and the more KuVIkBT increases. More specifically, in comparison with a sample (Hex·. 1,100 Oe) with a partial pressure of oxygen set at 10^{-7} Torr during the forming of the nonmagnetic metal spacer layer 4, the sample (Hex·. 2,000 Oe) with a partial pressure of oxygen set at 10^{-5} Torr, the fluctuation field is reduced by approximately 30 percent and Ku V/kBT increased by approximately 22 percent.

As shown in Fig. 7, when the partial pressure of oxygen is set in a range of 3×10^{-6} Torr to 3×10^{-5} Torr, a KuV/kBT value of 100 or more is obtained, indicating that magnetic recording media excellent in thermal stability have been obtained. And in a range where KuVIkBT of 100 or more can be obtained, Hex of the ferromagnetic film showed a high value of 1,500 Oe or above. According to the production method related to the present invention, it is possible to produce magnetic recording media far better in thermal stability by setting the partial pressure of oxygen during the formation of the nonmagnetic metal spacer layer 4 in an adequate range. Specification at pages 18-19.

By contrast, as shown in Fig. 6 on page 6146 of Egelhoff, the optimal value of O_2 pressure is 5×10^{-9} Torr in terms of maximizing GMR (giant magnetoresistance), and Egelhoff notes that "the beneficial effect of oxygen exists in a rather narrow window around 5×10^{-9} Torr." By contrast, the range of the partial pressure of oxygen which is effective in this application, and is particularly recited in claims 1 and 19, is considerably different.

With respect to both Maseeka and Shimizu, the examiner urges that "it would have been obvious to one of ordinary skill in the art in light of the prior art to optimize the partial pressure as a workable parameter in order to obtain a desirable oxygen adsorption or concentration on the targeted surface," citing Egelhoff at pages 6144-6146] The optimal value in terms of KuV/K_BT (an index of thermal stability) as shown in Fig. 8 of the present application is about 10^{-5} Torr, several orders of magnitude different than that in Egelhoff. Thus, it would not have been obvious based on either Maseeka or Shimizu to modify the partial pressure in Egelhoff to this degree, since Egelhoff clearly teaches away from values in the ranges recited in claims 1 and 19. This difference in the optimal value is due to a difference in the configuration, including the difference of the underlayer (metal layer versus the electrically insulating, and hence clearly not

metal, NiO material which is an antiferromagnetic layer which is exchange coupled to the pinned layer) between the invention according to Egelhoff, and the invention of this application.

With respect to the claims as amended and Maseeka, it is reiterated that Maseeka describes "a magnetic recording medium which greatly decreases a transition noise in a layered magnetic recording layer, excels in an S/N ratio, and is suited for short wavelength recording, the magnetic recording medium includes a vertical magnetic recording film 5 comprising an artificial lattice film formed by alternately layering a Pt or Pd layer and a Co layer and containing B and O elements." The B and O elements are contained in both the Co and Pt layers which constitute the layered magnetic recording layer 5. Thus, Maseeka discloses a perpendicular magnetic recording film that contains B and O, but it includes no teaching or suggestion of the present invention in which oxygen and/or nitrogen are physically absorbed at least at the interface between a nonmagnetic metal spacer layer or layers and ferromagnetic films.

Shimizu similarly fails to suggest that at least the interface between a nonmagnetic metal spacer layer or layers and ferromagnetic films is allowed to adsorb physically oxygen and/or nitrogen. Like Maseeka, it is relied upon merely as teaching that oxygen gas can be diluted with Ar or other rare gases to affect the concentration. Therefore claims 1 and 19 as amended also would not have been obvious based on Egelhoff in view of Shimizu. Reconsideration and withdrawal of the rejections based on Carey in view of Egelhoff taken in view of either Maseeka or Shimizu are respectfully requested.

Claim 7 is rejected under Section 103(a) based on Carey in view of Egelhoff in view of either Hartsough or Fukuzawa. Each of these secondary references is merely relied upon teaching that "oxidation may be controlled based upon units of Langmuir for exposure, wherein such units may determine the speed at which oxidation is performed" (Hartsough), and that "the prior art teaches Langmuir affects the amount of oxygen provided on the targeted surface" (Fujikawa). Neither reference overcomes the failure of Carey and Egelhoff taken with Maseeka or Shimizu to suggest that oxygen and/or nitrogen be physically absorbed at least at the interface between a nonmagnetic metal spacer layer or layers and ferromagnetic films. Reconsideration and withdrawal of the rejections based on Carey and Egelhoff in combination with Hartsough or Fukuzawa are respectfully requested.

If there are any problems with this response, or if the examiner believes that a telephone interview would advance the prosecution of the present application, Applicant's attorney would

appreciate a telephone call. In view of the foregoing, it is believed none of the references, taken singly or in combination, disclose the claimed invention. Accordingly, this application is believed to be in condition for allowance, the notice of which is respectfully requested.

Respectfully submitted,

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